

IN THE SPECIFICATION:

Please replace paragraph number [0001] with the following rewritten paragraph:

[0001] The present application is related to co-pending U.S. Patent Application Serial No. XXX,XXX,XXX 10/727,093 entitled METHOD AND APPARATUS FOR SUPPRESSION OF FIRES, filed on even date herewith and assigned to the Assignee of the present application, the disclosure of which is incorporated by reference herein in its entirety.

Please replace paragraph number [0004] with the following rewritten paragraph:

[0004] Other fire suppression systems have utilized a propellant to generate the inert gas. The propellant is ignited to generate the inert gas, which is then used to extinguish the fire. The inert gas typically includes nitrogen, carbon dioxide (CO<sub>2</sub>), or water. Some propellants used in fire suppression systems produce up to 20% by volume of CO<sub>2</sub>. While CO<sub>2</sub> is a nonflammable gas that effectively extinguishes fires, propellants that generate copious amounts of CO<sub>2</sub> ~~can not~~ cannot be used to extinguish fires in a human-occupied space because CO<sub>2</sub> is physiologically harmful. CO<sub>2</sub> has an Immediately Harmful to Life or Health (IDLH) value of a concentration of 4% by volume and causes the human breathing rate to quadruple at levels from 4% by volume to 5% by volume, loss of consciousness within minutes at levels from 5% by volume to 10% by volume, and death by asphyxiation with prolonged exposure at these or higher levels. In addition, it is difficult to produce CO<sub>2</sub> by combustion without producing significant amounts of carbon monoxide (CO), which has an IDLH of 0.12% by volume (i.e., 1200 parts per million (ppm)). Many propellants also produce other gaseous combustion products, such as ammonia (NH<sub>3</sub>), which has an IDLH of 300 ppm; nitric oxide (NO), which has an IDLH of 100 ppm; or nitrogen dioxide (NO<sub>2</sub>), which has an IDLH of 20 ppm. NO and NO<sub>2</sub> are collectively referred to herein as nitrogen oxides ("NO<sub>x</sub>"). CO<sub>2</sub>, CO, NH<sub>3</sub>, and NO<sub>x</sub> are toxic to people and, therefore, producing these gases is undesirable, especially if the fire suppression system is to be used in a human-occupied space. Furthermore, many of these propellants produce particulate matter when they are combusted. The particulate matter may damage sensitive equipment and equipment, is potentially an inhalation hazard, irritates the skin and eyes, and

forms a hazardous solid waste that must be properly disposed of. In United States Patent No. 6,024,889 to Holland *et al.*, a chemically active fire suppression composition is disclosed. The fire suppression composition includes an oxidizer, a fuel, and a chemical fire suppressant and produces CO<sub>2</sub>, nitrogen, and water when combusted. The composition also undesirably produces smoke and particulate matter upon combustion.

Please replace paragraph number [0006] with the following rewritten paragraph:

**[0006]** A-~~non-azide-based~~ nonazide-based fire suppression system is disclosed in United States Patent No. 5,957,210 to Cohrt *et al.* In the fire suppression system, ammonia is reacted with atmospheric air or compressed air to produce nitrogen and water vapor. The ammonia and air are reacted in a combustion chamber of a gas turbine to produce combustion gases that are exhausted into a mixing chamber before being introduced into an enclosed space. Water is sprayed into the combustion chamber to cool the combustion gases. The introduction of the combustion gases into the enclosed space reduces its oxygen content and extinguishes the fire.

Please replace paragraph number [0021] with the following rewritten paragraph:

**[0021]** The inert gas mixture may be generated pyrotechnically by igniting a gas generant that produces gaseous combustion products. The gaseous combustion products may include gases that do not contribute to ozone depletion or global warming. As such, these gases may be used in the inert gas mixture. The gaseous combustion products may include minimal, ~~non-~~nonhazardous amounts of noxious gases, such as NH<sub>3</sub>, CO, NO<sub>x</sub>, or mixtures thereof. In one embodiment, the gas generant produces significantly less than the respective IDLH of each of these gases and less than 1% of an original weight of the gas generant in particulates or smoke. The gas generant may also produce minimal amounts of other ~~carbon-~~carbon-containing gases, such as CO<sub>2</sub>. In one embodiment, the gas generant produces less than approximately 4% by volume of CO<sub>2</sub>. The gas generant may be formulated to produce minimal carbon dioxide, particulates, or smoke when combusted and to produce a physiologically acceptable balance of toxic gases produced under fuel rich (CO and NH<sub>3</sub>) or fuel lean (NO<sub>x</sub>) conditions. Solid

combustion products are ultimately produced upon combustion of the gas generant and may be essentially free of products that vaporize at the flame temperature of the gas generant and may solidify upon cooling to produce particulates and smoke that are respirable.

Please replace paragraph number [0023] with the following rewritten paragraph:

**[0023]** The fire suppression system 2 may include a combustion chamber 4 and an effluent train 6, as shown in FIGs. 1 and 2. The fire suppression system 2 may be formed from a material and construction design having sufficient strength to withstand pressures generated by the gas generant 8. The pressures generated in the fire suppression system 2 may range from approximately 100 pounds per square inch (“psi”) to approximately ~~1000~~ 1,000 psi, such as from approximately 600 psi to approximately 800 psi. To withstand these pressures, an outer surface of the combustion chamber 4 and the effluent train 6 may be formed from a metal, such as steel. The ignition ~~train~~ 3 train may be electrically activated, as known in the art. The gas generant 8 and an igniter composition 14 may be housed in the combustion chamber 4. The gas generant 8 may be present in the combustion chamber 4 as a pellet 16 or the gas generant 8 and the igniter composition 14 may be pelletized, as described in more detail below. Embodiments of the pellet 16 are illustrated in FIGs. 3a and 3b and are described in more detail below.

Please replace paragraph number [0024] with the following rewritten paragraph:

**[0024]** The gas generant 8 in the combustion chamber 4 may be ignited to produce the gaseous combustion products of the inert gas mixture by an ignition ~~train~~ 3 train using sensors that are configured to detect the presence of the fire in the space. The sensors may initiate an electrical impulse in the ignition ~~train~~ 3 train. The sensors are conventional and, as such, are not discussed in detail herein. The electrical impulse may then ignite an initiating device 12, such as a squib, semiconductor bridge, or other conventional initiating device. Heat flux from the initiating device 12 may be used to ignite the igniter composition 14, which, in turn, ignites the gas generant 8. The igniter composition 14 and the gas generant 8 are described in more detail below. When ignited or combusted, the igniter composition 14 may produce an amount of heat sufficient to ignite the gas generant 8. Alternatively, the initiating device 12 may be used to

directly ignite the gas generant 8. In one embodiment, the igniter composition 14 produces solid combustion products, with minimal production of gaseous combustion products. The combustion products produced by this igniter composition 14 may include a minimal amount of carbon-containing combustion products.

Please replace paragraph number [0025] with the following rewritten paragraph:

[0025] In addition to housing the ignition ~~train-3~~ train, the combustion chamber 4 may house the igniter composition 14 and the gas generant 8. The gas generant 8 may be formed into a pellet 16 for use in the fire suppression system 2. Alternatively, the pellet 16 may include the gas generant 8 and the igniter composition 14, with the igniter composition 14 present predominantly on an outer surface of the pellet 16. The gas generant 8 may be a ~~non-~~nonazide gas generant composition that produces gaseous combustion products and solid combustion products. The gaseous combustion products may be substantially free of carbon-containing gases or NO<sub>x</sub>. Effluents produced by the combustion of the gas generant 8 may be substantially free of NO<sub>2</sub> and may have less than 100 parts per million (“ppm”) of other effluents, such as CO or NH<sub>3</sub>. For instance, the gas generant 8 may produce nitrogen and water as its gaseous combustion products. At least a portion of the gaseous combustion products produced by combustion of the gas generant 8 may form the inert gas mixture. In one embodiment, substantially all of the gaseous combustion products form the inert gas mixture so that a mass of the gas generant 8 used in the pellet 16 may remain as small as possible but yet still produce an effective amount of the inert gas mixture to extinguish the fire. A catalyst may also be present in the gas generant 8 to convert undesirable, toxic gases into less toxic, inert gases that may be used in fire suppression. The gaseous combustion products may be generated within a short amount of time after the gas generant 8 is ignited. For instance, the gas generant 8 may produce the gaseous combustion products within approximately 20 seconds to approximately 60 seconds after its ignition so that the inert gas mixture may be dispersed and the fire extinguished within approximately 30 seconds to approximately 60 seconds.

Please replace paragraph number [0028] with the following rewritten paragraph:

**[0028]** The HACN composition, or other gas generants 8, may include additional ingredients, such as at least one of an oxidizing agent, ignition enhancer, ballistic modifier, slag enhancing agent, cooling agent, ~~a chemical~~ chemical fire suppressant, inorganic binder, or an organic binder. Many additives used in the gas generant 8 may have multiple purposes. For sake of example only, an additive used as an oxidizer may provide cooling, ballistic modifying, or slag enhancing properties to the gas generant 8. The oxidizing agent may be used to promote oxidation of the activated charcoal present in the HACN or of the ammonia groups coordinated to the cobalt in the HACN. The oxidizing agent may be an ammonium nitrate, an alkali metal nitrate, an alkaline earth nitrate, an ammonium perchlorate, an alkali metal perchlorate, an alkaline earth perchlorate, an ammonium peroxide, an alkali metal peroxide, or an alkaline earth peroxide. The oxidizing agent may also be a transition metal-based oxidizer, such as a copper-based oxidizer, that includes, but is not limited to, basic copper nitrate ( $[\text{Cu}_2(\text{OH})_3\text{NO}_3]$ ) (“BCN”),  $\text{Cu}_2\text{O}$ , or  $\text{CuO}$ . In addition to being oxidizers, the copper-based oxidizer may act as a coolant, a ballistic modifier, or a slag enhancing agent. Upon combustion of the gas generant 8, the copper-based oxidizer may produce copper-containing combustion products, such as copper metal and cuprous oxide, which are miscible with cobalt combustion products, such as cobalt metal and cobaltous oxide. These combustion products produce a molten slag, which fuses at or near the burning surface of the pellet 16 and prevents particulates from being formed. The copper-based oxidizer may also lower the pressure exponent of the gas generant 8, decreasing the pressure dependence of the burn rate. Typically, HACN-containing gas generants 8 that include copper-based oxidizers ignite more readily and burn more rapidly at or near atmospheric pressure. However, due to the lower pressure dependence, they burn less rapidly at extremely high pressures, such as those greater than approximately 3000 psi.

Please replace paragraph number [0040] with the following rewritten paragraph:

**[0040]** As previously described, the gas generant 8 or the igniter composition 14 and the gas generant 8 may be formed into the pellet 16. The pellet 16 may be formed by compressing the gas generant 8 or the igniter composition 14 and the gas generant 8 together to

form a cylindrically-~~shaped~~shaped pellet 16, as illustrated in FIG. 3a. However, the geometry of the gas generant 8 used in the fire suppression system 2 may depend on a desired ballistic performance of the gas generant 8, such as a desired burn rate or rate of evolution of the inert gas mixture as a function of time. Burn rates are typically categorized as a progressive burn, a regressive burn, or a neutral burn. A progressive burn is provided when the burning surface of the pellet 16 increases gradually as the pellet 16 burns. In a progressive burn, the rate of evolution of the inert gas mixture increases as a function of time. A regressive burn is provided when the burning surface of the pellet 16 decreases gradually as the pellet 16 burns. In a regressive burn, the rate of evolution of the inert gas mixture is initially high and decreases as a function of time. If the burning surface of the pellet 16 burns at a constant rate, a neutral burn is provided. In one embodiment, the gas generant 8 is formed into a pellet 16 having a center-perforated grain geometry, as illustrated in FIG. 3b. The center-perforated grain geometry has a high surface area, burns rapidly, and provides a neutral burn. The pellet 16 may also be formed into other shapes that provide a neutral burn as opposed to a regressive or progressive burn. The center-perforated pellet 16 may be produced using an appropriately designed die or by drilling a hole into a cylindrical pellet 16, using appropriate safety precautions.

Please replace paragraph number [0043] with the following rewritten paragraph:

[0043] The pellet 16 may be formed by layering the granules of the igniter composition 14 above or below the layer of the gas generant 8 in a die so that the igniter composition 14 and the gas generant 8 are in contact with one another. A pressure of approximately ~~8000~~ 8,000 psi may be used to form the pellet 16, which has a porosity ranging from approximately 5% to approximately 20%. The igniter composition 14 and the gas generant 8 may be compressed into the pellet 16 using a metal sleeve or a metal can, which provides support while the pellet 16 is being produced, handled, or stored. The metal can or the metal sleeve may also be used to inhibit burning of surfaces of the pellet 16 that are enclosed by the metal sheathing. In the fire suppression system 2 of the present invention, the pellet 16 may burn at a controlled rate so that the amount of inert gas mixture produced during the burn remains constant as a function of time. To achieve a neutral burn, at least one surface of the

pellet 16 may be covered or inhibited by the metal can or metal sleeve so that these surfaces do not burn. An inner surface of the metal sheathing may also be painted with an inert inorganic material, such as sodium silicate or a suspension of magnesium oxide in sodium silicate, to inhibit the surfaces of the pellet 16.

Please replace paragraph number [0044] with the following rewritten paragraph:

[0044] The pellets 16 may be housed in the combustion chamber 4 and have a total mass that is sufficient to produce an amount of the inert gas mixture sufficient for extinguishing the fire in the space. For sake of example only, in order to lower the oxygen concentration and extinguish a fire in a-1000 1,000 cubic foot space, the gas generant 8 may have a total mass of approximately 40 pounds. The inert gas mixture produced by the combustion of the gas generant 8 may lower the oxygen concentration in the space to a level that sustains human life for a limited duration of time. For instance, the oxygen concentration in the space may be lowered to approximately 13% by volume for approximately five minutes

Please replace paragraph number [0045] with the following rewritten paragraph:

[0045] The combustion chamber 4 may be configured to house multiple pellets 16 of the gas generant 8 or the igniter composition 14 and the gas generant 8. Therefore, the fire suppression system 2 of the present invention may be easily configured for use in spaces of various sizes. For instance, the fire suppression system 2 may include one pellet 16 if the fire suppression system 2 is to be used in a small space. However, if the fire suppression system 2 is to be used in a larger space, the combustion chamber 4 may include two or more pellets 16 so that the sufficient amount of the inert gas mixture may be produced. For sake of example only, in a 500 cubic foot space, four pellets 16 having a 5.8-inch outer diameter, a 2.6-inch height, and a weight of 4.44 pounds may be used, while eight of these pellets 16 may be used in a-1000 1,000 cubic foot space. In a-2000 2,000 cubic foot space, two generators, each containing eight pellets 16, may be strategically positioned. The pellets 16 may have an effective burning surface area so that the inert gas mixture may be produced within a short time period after initiation of the gas generant 8. For instance, the inert gas mixture may be produced with approximately

20 seconds to approximately 60 seconds after initiation of the gas generant 8. If the fire suppression system 2 includes multiple pellets 16, the pellets 16 may be ignited so that they are combusted simultaneously to provide a sufficient amount of the inert gas mixture to extinguish the fire. Alternatively, the pellets 16 may be ignited sequentially so that the inert gas mixture is produced at staggered intervals.

Please replace paragraph number [0046] with the following rewritten paragraph:

**[0046]** In one embodiment, the ignition train includes a squib, which when electrically activated, ignites a granular or pelletized composition of B/KNO<sub>3</sub> in an ignition chamber. The hot effluents produced by combustion of the B/KNO<sub>3</sub> composition pass into the combustion chamber 4 and ignite the secondary ignition or igniter composition 14, which may be located in the metallic foil packet, pressed or painted on the surface of the pellet 16, or placed in the perforated flash tube positioned in the center-perforation of the pellet 16.

Please replace paragraph number [0049] with the following rewritten paragraph:

**[0049]** In the diffuser chamber 72, plumes of the high velocity, inert gas mixture impinge on a flow deflector 74. The flow deflector 74 recirculates the inert gas mixture and results in a more uniform flow through a perforated diffuser plate or first diffuser plate 24. The first diffuser plate 24 may disperse the inert gas mixture so that it does not exit the gas generator 70 as a high velocity jet. The inert gas mixture then passes through a heat management system 26 that includes cooling media or effluent scavenging media. The heat management system 26 may reduce the temperature of the inert gas mixture to a temperature that is appropriate to suppress the fire. Since combustion of the gas generant 8 produces a significant amount of heat in the gas generator 70, the inert gas mixture may be cooled before it is introduced into the space. For sake of example only, the heat released from a gas generant 8 combusted in a 2,000 cubic foot space may be approximately 40,000 British Thermal Units (“BTU”). In one embodiment, the heat management system 26 is a heat sink. The heat sink may be formed from conventional materials that are shaped into beds, beads, or tube clusters. The materials used in the heat sink may include, but are not limited to, metal, graphite, or ceramics.

The material used in the heat sink and the geometry of the heat sink may be selected by one of ordinary skill in the art so that the heat sink provides the appropriate heat transfer surface, thermal conductivity, heat capacity, and thermal mass.

Please replace paragraph number [0051] with the following rewritten paragraph:

[0051] The cooled, inert gas mixture may then be dispersed into the space through at least one final orifice 32, which reduces the pressure of the inert gas mixture relative to the pressure in the gas generator 70. The geometry of the final orifice(s) ~~may~~ 32 may be selected based on the geometry of the space and the placement of the fire suppression system 2 in the space. Since the inert gas mixture is generated pyrotechnically, high pressure gas storage tanks and accompanying hardware to disperse the inert gas mixture may not be needed in the fire suppression system 2 of the present invention.

Please replace paragraph number [0057] with the following rewritten paragraph:

[0057] A gas generant including HACN, BCN, and Fe<sub>2</sub>O<sub>3</sub> was produced in the slurry reactor. A 10 liter baffled slurry tank was filled with ~~4900~~ 4,900 grams of distilled water and stirred with ~~a 3-blade~~ three blade stationary impeller at 600 revolutions per minute (“rpm”). A glycol heating bath was used to heat the water to 180°F. After the water temperature reached 180°F, 586.1 g of technical grade HACN was added to the mixer and stirred at 600 rpm for 10 minutes to allow the HACN to dissolve. 111.64 g of BCN and 18.56 g of Fe<sub>2</sub>O<sub>3</sub> were dry blended together in a Nalgene™ quart container. 100 g of distilled water were then added into the blended BCN/ Fe<sub>2</sub>O<sub>3</sub> and stirred for 5 minutes until an even suspension was made. 58 g of this suspension of BCN/ Fe<sub>2</sub>O<sub>3</sub>/water was then injected slowly into the mix bowl with a 30 cc syringe while mixing rapidly. The slow addition of solid into the mix bowl allows for better oxidizer distribution in the mix. The heating system of the mix bowl was then turned off and the system was cooled at 1.4°F/minute by melting ice on the exterior of the mix bowl. When the mix temperature reached 160°F, a second addition of 58 g of BCN/ Fe<sub>2</sub>O<sub>3</sub>/water was injected slowly into the mix bowl with a 30 cc syringe while mixing rapidly. Cooling with ice was continued after this addition. When the temperature reached 139.7°F, a third addition of 58 g of BCN/

$\text{Fe}_2\text{O}_3$ /water was then injected slowly into the mix bowl with a 30 cc syringe while mixing rapidly. Cooling with ice was continued after this addition. When the temperature reached 119.9°F, 56.2 g (the remainder of the suspension) of BCN/  $\text{Fe}_2\text{O}_3$ /water was injected slowly into the mix bowl with a 30 cc syringe while mixing rapidly. Cooling with ice was continued after this addition until the temperature reached 75.4°F. At that time, the impellar was stopped and the material was transferred out of the mix bowl and into a five gallon bucket. The mix was then filtered in a vacuum Erlenmeyer flask with a 1- $\mu\text{m}$  paper filter. The mixed gas generant was then placed onto a glass tray and dried at 165°F overnight to remove any moisture.

Please replace paragraph number [0058] with the following rewritten paragraph:

[0058] A ~~5-gallon~~ five gallon Baker Perkins vertical mixer was filled with 10,857 g of distilled water and stirred at 482 rpm. The mix bowl was heated to 165°F. After the water temperature reached 165°F, ~~3160.0~~ 3,160.0 g of recrystallized HACN was added into the mixer and stirred slowly at 482 rpm for 15 minutes to allow the HACN to partially dissolve and break up any clumps. ~~1800~~ 1,800 g of  $\text{Cu}_2\text{O}$  and 720 g  ~~$\text{TiO}_2$  of~~  $\text{TiO}_2$  were then dry blended by sealing a five gallon bucket and shaking it. The mixer was stopped and the walls and blades were scraped down to incorporate any material that may have migrated up the mix blades. Then, the blend of  $\text{Cu}_2\text{O}$  and  $\text{TiO}_2$  was added ~~into~~ to the mix bowl and mixed for 15 minutes at 482 rpm. The mixer was stopped and the walls and blades were scraped down to incorporate any material that may have migrated up the mix blades. Then, ~~3160~~ 3,160 g of recrystallized HACN was added into the mix bowl and mixed for 15 minutes at 482 rpm. The mixer was stopped and the walls and blades were scraped down. The mixture was mixed for 30 minutes at ~~1760~~ 1,760 rpm. The mixer was stopped and the walls and blades were scraped. Then, the mixture was mixed for 30 minutes at ~~1760~~ 1,760 rpm. The mixture was loaded onto velo-stat lined trays and dried at 165°F. After drying, the coarse, granular material was granulated to a consistent small granule size using a Stokes granulator.

Please replace paragraph number [0059] with the following rewritten paragraph:

[0059] To a ~~1-gallon~~ one gallon Baker Perkins vertical mixer, ~~2,730~~ 2,730 g of recrystallized HACN and 35 g of granular Cytec Cyanamer N-300 polyacrylamide ~~was~~ were added. The two solids were blended for two minutes, after which ~~1,750~~ 1,750 g of deionized water was added. The resulting slurry was mixed for 15 minutes. The mixer was stopped and the walls and blades were scraped down to incorporate any material that may have migrated up the mix blades.

Please replace paragraph number [0061] with the following rewritten paragraph:

[0061] To a ~~2~~ two cubic foot rotating double-cone dryer, 2,996 g of cupric oxide and 817 g of titanium dioxide were added. The material was blended for 20 minutes by way of rotation of the rotating double-cone dryer. Afterwards, the inside walls of the rotating double-cone dryer were scraped down to free any unblended material. Next, 23,426 g of recrystallized HACN ~~were~~ was added to the rotating double-cone dryer. The material was blended for an additional thirty minutes and then collected.

Please replace paragraph number [0062] with the following rewritten paragraph:

#### Example 5

A HACN Gas Generant Containing ~~a Curable~~ an Organic Binder Produced in a Muller Mixer

[0062] A polymer preblend was prepared by mixing 82 g of Crompton Corp. Fomrez F17-80 polyester resin with 17.4 g of Vantico Inc. Araldite MY0510 multifunctional epoxy resin and 0.6 g of powdered magnesium carbonate. To a 12" diameter muller mixer, 10 g of the polymer preblend and ~~1,636~~ 1,636 g of recrystallized HACN were added. This was blended for 10 minutes and the mixing surfaces were scraped down. Then, 294 g of American Chemet Corp. UP13600FM cupric oxide and 60 g of DeGussa P-25 titanium dioxide were added and the composition was mixed for 5 minutes. The mixer was again scraped down and the composition was blended for ~~a further~~ another 10 minutes. The composition was placed in a freezer and allowed to warm to room temperature immediately before pressing it into a pellet.

Please replace paragraph number [0063] with the following rewritten paragraph:

**[0063]** Pellets formed from the gas generants described in Examples 1, 2, or 4 were produced. To press the pellets, a 1.13 inch die assembly was used. A mold release agent, polytetrafluoroethylene (“PTFE”), was liberally applied to the die anvil and foot to minimize material sticking during the press cycle. 1.5 g of an igniter composition having a mixture of 60% B/KNO<sub>3</sub> and 40% Mg/Sr(NO<sub>3</sub>)<sub>2</sub>/binder was added to the die and leveled off with a spatula. The igniter composition was produced by blending together granules of the B/KNO<sub>3</sub> and Mg/Sr(NO<sub>3</sub>)<sub>2</sub>/binder. 10 g of the gas generant described in Examples 1, 2, or 4-were was added to the die. The press foot was inserted into the top of the die assembly and twisted to ensure proper alignment. The pellet was pressed for 60 seconds at-8000 8,000 lb<sub>f</sub> (80008,000 psi). After pressing, the anvil was removed from the assembly and the pellet was pressed out of the die into a padded cup to minimize damage.

Please replace paragraph number [0064] with the following rewritten paragraph:

**[0064]** Sleeved pellets formed from the gas generants described in Examples 1, 2, or 4 were produced. The press anvil and foot of the die were liberally sprayed with PTFE. A 1.05 inch internal diameter (“ID”) steel ring was placed on the press anvil. 1.2 g of an igniter composition having a mixture of 60% B/KNO<sub>3</sub> and 40% Mg/Sr(NO<sub>3</sub>)<sub>2</sub>/binder was then added inside the steel ring. The surface of the igniter composition was then leveled with a spatula to ensure an even layer of the igniter composition on one surface of the pellet. An alignment sleeve was placed on top of the steel sleeve and 14.5 g of the gas generant described in Examples 1 or 2 was poured inside the alignment tool. A 1.00 inch outer diameter (“OD”) press foot was inserted into the die. The sleeved pellet was pressed for 60 seconds at-6900 6,900 lb<sub>f</sub> (80008,000 psi). After pressing, the top surface of the sleeved pellet matched the top layer of the steel ring. Therefore, no post pressing process was required to remove the pellet from the press die. Instead, the anvil and alignment piece pulled off easily, leaving a filled steel ring of the gas generant.

Please replace paragraph number [0065] with the following rewritten paragraph:

**[0065]** Sleeved pellets were also pressed with embedded hot wires by running a loop of tungsten wire having a 0.010 inch-~~outer diameter~~ (“OD”) OD through two holes on the press anvil. The wire leads were rolled up and stored in the labeled opening on the underside of the press anvil. After installing the hot wire in the pressing fixture, the procedure for sleeved pellets (described in Example 7) was followed.

Please replace paragraph number [0066] with the following rewritten paragraph:

**[0066]** 3.3 pound pellets were pressed using a 150-ton hydraulic press. The anvil and press foot were sprayed liberally with PTFE. The anvil was then inserted into the die walls. 39.6 g of the igniter composition (40% B/KNO<sub>3</sub> and 60% Mg/Sr(NO<sub>3</sub>)<sub>2</sub>/binder) was added to the die by slowly pouring the material in a circular coil pattern starting at the center of the anvil and moving outward toward the die wall. The igniter composition was then leveled on top of the press anvil with a spatula. After ensuring an even layer of the igniter composition, ~~1500~~ 1,500 g of the gas generant described in Examples 1, 2, or 4 was added to the die. The press foot was then carefully inserted into the die. To ensure proper alignment, the press foot was spun around to ensure that no gas generant was trapped between the die walls and press foot. After alignment, the pellet was pressed at 211,000 lb<sub>f</sub> (~~8000~~8,000 psi) for 60 seconds. To remove the pellet, the press anvil was removed and the die walls were positioned on top of a 6.0 inch inner diameter (“ID”) knockout cup. A slight amount of force was applied to the press foot to push the pellet out of the 5.8 inch die walls.

Please replace paragraph number [0067] with the following rewritten paragraph:

**[0067]** The gas generant (737 g) described in Example 4 was added to a carbon steel can having an OD of 6.0 inches, an ID of 5.8 inches, a height of 2.15 inches, and a depth of 2.06 inches and pressed using a 150-ton hydraulic press to a maximum pressure of ~~8042~~ 8,042 psi. Pressure was maintained at or above ~~8000~~ 8,000 psi for one minute. A second addition of 740 g of the gas generant was added to the press die along ~~with~~ with a 59.4 g blend of an igniter composition that included 11% B/KNO<sub>3</sub> and 89% Mg/Sr(NO<sub>3</sub>)<sub>2</sub>/binder. The igniter

composition was spread evenly on the top surface of the gas generant. The remaining gas generant and the igniter composition were then pressed at ~~8197~~ 8,197 psi for one minute. The total height of the gas generant and igniter composition after the final press cycle was 2.01 inches.

Please replace paragraph number [0073] with the following rewritten paragraph:

[0073] Pellets 16 having a mass of from approximately 20 g to approximately 25 g were ignited in the mini-generator. The gaseous combustion products (or effluent gases) of the pellets 16 were transferred into gas-impermeable bags and tested to determine the contents of the gaseous combustion products. The gaseous combustion products were tested using a conventional, colorimetric assay, i.e., the Draeger Tube System, which is known in the art. In the mini-generator, CO levels decreased from ~~2000~~ 2,000 parts per million ("ppm") to 50 ppm. NO<sub>x</sub> levels decreased from ~~2000~~ 2,000 ppm to 150 ppm. In addition, a tough, unitary slag was produced.

Please replace paragraph number [0076] with the following rewritten paragraph:

[0076] Two ~~10 g~~ 10 g, 1.1-OD cylindrical pellets 16 were pressed at ~~8000~~ 8,000 psi. One pellet 16 included the gas generant 8 described in Example 4. The other pellet 16 included 90% by weight of the gas generant 8 described in Example 4 blended with 10% by weight of Warner-Bronz finely-finely-divided bronze flakes, produced by Warner Electric Co., Inc. On the top surface of each pellet 16, 0.5 g of granular Mg/Sr(NO<sub>3</sub>)<sub>2</sub>/binder was present. The igniter composition 14 on each pellet 16 was ignited by a hot wire. The pellet 16 that included the finely divided bronze flakes ignited more smoothly, combusted more rapidly, and produced a stiffer slag once combusted compared to the pellet 16 without the finely divided bronze flakes.

Please replace paragraph number [0077] with the following rewritten paragraph:

[0077] HACN gas generant compositions were mixed similarly to those described in Examples 2, 3, 4, and 5. For each composition, three 0.5 inch diameter, 4.0 g pellets were pressed at ~~2000~~ 2,000 lbs force for 20 seconds. In addition, three 1.1 inch diameter, 15.0 g

pellets were pressed at 10,000 lbs force for 20 seconds. The pellets were analyzed for crush strength at a 0.125 in/min compression rate. The 0.5 inch pellets were used to determine axial crush strength and the 1.1 inch diameter pellets were analyzed for radial crush strength. The data are summarized in Table 1 and show that pellets 16 having the organic binder or inorganic binder had improved axial crush strength compared to those compositions having no binder. In addition, many of the pellets 16 had improved radial crush strength compared to those compositions having no binder.

Please replace paragraph number [0079] with the following rewritten paragraph:

[0079] Larger, center-perforated pellets were fabricated by pressing ~~1520~~ 1,520 g of the HACN gas generant 8 in a 5.8" diameter die at ~~8000~~ 8,000 psi for a minimum of 1 minute. Once the pellets were pressed, a 1.25" diameter drill bit was used to produce a center-center perforation in the pellets. The pellets were tested in fire suppression system 2 as illustrated in FIG. 2 using the 100 cubic foot tank test described in Example 13. The ignition train utilized-a an ATK Thiokol Propulsion ES013 squib, 2 g of B/KNO<sub>3</sub> in the ignition chamber and 50 g of Mg/Sr(NO<sub>3</sub>)<sub>2</sub>/binder igniter composition in a foil packet placed on top of the center-perforated pellet. The pellets were then ignited and combustion analyses were performed on the gaseous combustion products. The combustion analyses are summarized in Table 3. Measured toxic gaseous effluent levels were generally lower in the larger scale tests compared to those in the small scale tests, which were described in Example 16.